

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appln. No. 10/026,454

REMARKS

The present invention relates to a wiring substrate comprising a layer having an opening, at least one electronic part disposed in the opening, and an embedding resin.

A Notice of Draftsperson's Patent Drawing Review, Form PTO-948, was attached to the Office Action, which indicated that the drawings filed on March 8, 2002 were objected to because they do not conform with the drawing requirements. In a telephonic communication on December 12, 2002, Examiner Williams informed the undersigned attorney that the drawings have been approved as indicated by approval stamps on the drawings.

In this Amendment, claims 5 and 6 have been amended to further define the filler by reciting a filler --having a particle size of from 0.1 to 50 μm in an amount of from 51 to 74% by weight--, and to specify the viscosity of the embedding resin as that --before embedding--. Support for these amendments is found, for example, in original claims 1, 8 and 11, and at page 5 of the present specification.

Claims 8 and 11 have accordingly been cancelled.

Claims 7, 9, 10 and 12 have been amended to replace "The embedding resin" with --The wiring substrate--. Support for this amendment is found, for example, in original claim 5.

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Claims 7 and 10 have also been amended to recite a viscosity of the curing agent --before embedding--. Support for this amendment is found in the specification, for example, at page 5, lines 14 to 16.

No new matter has been added and entry of this Amendment is respectfully submitted to be proper. Upon entry of this Amendment, claims 1-7, 9, 10 and 12 are all the claims pending in the application.

At page 2 of the Office Action, it was asserted that the title is not descriptive.

Applicants respectfully submit that the title as amended is proper. In this Amendment, Applicants have amended the title to recite --WIRING SUBSTRATE USING EMBEDDING RESIN--.

At page 2 of the Office Action, the Abstract has been objected to as to its contents.

Applicants respectfully submit that the Abstract as amended is proper. In this Amendment, Applicants have amended the abstract to direct to --A wiring substrate--, as claimed in the present application.

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At page 3 of the Office Action, the Examiner referred to a substituted specification purportedly filed on March 8, 2002, and stated that such has not been entered for lack of a marked-up copy of the specification.

It appears that the “substitute specification” was simply a copy of the original specification. In a follow-up telephone communication, Examiner Williams agreed with the undersigned attorney that the “substitute specification” was a copy of the original specification.

At pages 3 and 4 of the Office Action, claims 5-12 have been rejected under the judicially created doctrine of double patenting over claims 10-15 of copending Application No. 10/024601, claims 7-10 of copending Application No. 10/025764, claims 4-8 of copending Application No. 10/042317, claims 1-6 of copending Application No. 10/024581, or claims 1-9 of copending Application No. 10/026928.

In response, Applicants have filed a Terminal Disclaimer herewith, and accordingly, respectfully request the Examiner to reconsider and withdraw these provisional rejections.

At page 6 of the Office Action, claims 7-12 have been rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite. Claims 7-12 have also been objected to for allegedly being dependent from one or more of the objected to claims.

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In particular, it was asserted that “The embedding resin” in claims 7-12 is unclear and confusing because the independent claims 5 and 6 refer to a wiring substrate.

Applicants respectfully submit that claims 7, 9, 10 and 12 as amended are not indefinite. In this Amendment, Applicants have amended claims 7, 9, 10 and 12 to replace “The embedding resin” with --The wiring substrate--. Applicants have also filed a Terminal Disclaimer to overcome the above rejections of claims 5 and 6, from which claims 7, 9, 10 and 12 depend.

Accordingly, the Examiner is respectfully requested to reconsider and withdraw the rejection and objection.

At page 7 of the Office Action, claims 5-12 has been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Konarski (US Patent Appln. Pub. No. 2001/0058756 A1).

In particular, it was asserted that Figs. 1 and 2 and claim 5 of Konarski show a wiring substrate comprising an insulating substrate 21 having an opening, at least one electronic part 2 disposed in the opening, and an embedding resin 23 comprising a thermoplastic resin, an acid anhydride curing agent, a curing accelerator, and a filler, wherein the at least one electronic part is embedded with the embedding resin.

Applicants respectfully submit that claims 5-12 as amended are not *prima facie* obvious over Konarski. In this Amendment, Applicants have amended claims 5 and 6 to further define the recited filler, by reciting its viscosity property, and to specify the viscosity of the embedding

resin. Specifically, claims 5 and 6 as amended recite a filler --having a particle size of from 0.1 to 50 μm in an amount of from 51 to 74% by weight--, and a viscosity of the embedding resin --before embedding--.

Konarski discloses that the thermosetting resin composition may also include a filler component in an amount of about 0.1 to about 400 weight percent (column 7, paragraphs 0095 and 0096). However, Konarski does not teach or suggest the particle size of the filler as set forth in the present claims.

As indicated in the present specification, when the particle size of the filler exceeds 50 μm , the filler may cause clogging in the gaps between the electrodes of the electronic parts. Such inferior filling of the embedding resin then generates the portions having extremely different local thermal expansion coefficient. On the other hand, when the particle size of the filler is finer than 0.1 μm , the fluidity of the embedding resin becomes hard to be insured (page 8, lines 5-15 of the present specification).

Accordingly, the particle size of the filler in the presently recited range shows unexpected superior results, and would not have been obvious to a person of ordinary skill in the art at the time of the present invention.

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In view of the above, the Examiner is respectfully requested to reconsider and withdraw the rejection.

At page 7 of the Office Action, claims 5-12 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Tsukagoshi et al (US Patent No. 5,120,665).

In particular, it was asserted that the Figures in Tsukagoshi et al show a wiring substrate comprising an insulating substrate 14 having an opening, at least one electronic part 11 disposed in the opening, an embedding resin comprising a thermoplastic resin, an acid anhydride curing agent, a curing accelerator, and a filler, wherein the at least one electronic part is embedded with the embedding resin (Figs. 1a-9).

Applicants respectfully submit that the claims as amended are not *prima facie* obvious over Tsukagoshi et al. In this Amendment, Applicants have amended claims 5 and 6 to further define the recited filler, by reciting its viscosity property, and to specify the viscosity of the embedding resin. Specifically, claims 5 and 6 as amended recite a filler --having a particle size of from 0.1 to 50 μm in an amount of from 51 to 74% by weight--, and a viscosity of the embedding resin --before embedding--.

Tsukagoshi et al disclose that the resin composition may further contains a filler (column 7, lines 8-9). However, Tsukagoshi et al do not teach or suggest the particle size or amount of the filler as set forth in the present claims.

Regarding the particle size of the filler, as indicated in the present specification, when the particle size of the filler exceeds 50 μm , the filler may cause clogging in the gaps between the electrodes of the electronic parts. Such inferior filling of the embedding resin then generates the portions having extremely different local thermal expansion coefficient. On the other hand, when the particle size of the filler is finer than 0.1 μm , the fluidity of the embedding resin becomes hard to be insured (page 8, lines 5-15 of the present specification).

Regarding the amount of the filler in the composition, as indicated in the present specification, when the amount of the filler is less than 45% by weight, the difference of the thermal expansion coefficient between the core substrate and the material becoming the build-up material becomes large, which causes the generation of cracks at application of a heat cycle. On the other hand, when the amount of the filler exceeds 90% by weight, the viscosity of the embedding resin becomes high and the filling property thereof is greatly deteriorated to cause the entrance of bubbles (page 7, lines 4-12 of the present specification).

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Accordingly, the particle size and amount of the filler in the presently recited ranges show unexpected superior results and it would not have been obvious to a person of ordinary skill in the art at the time of the present invention.

In view of the above, the Examiner is respectfully requested to reconsider and withdraw the rejection based on Tsukagoshi et al.

At page 8 of the Office Action, claims 5-12 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Sumita et al (U.S. Pat. No. 6,429, 238).

In particular, it was asserted that Sumita et al teach a wiring substrate, comprising (1) an insulating substrate having an opening, (2) at least one electronic part disposed in the opening, and (3) an embedding resin comprising a thermoplastic resin, an acid anhydride curing agent, a curing accelerator, and a filler, wherein the at least one electronic part is embedded with the embedding resin (citing claim 5 and Figs. 1 to 2A).

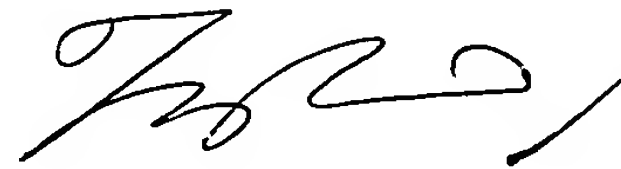
Applicants respectfully submit that claims 5-12 as amended are not *prima facie* obvious over Sumita et al, because Sumita et al do not disclose or suggest the viscosity of the embedding resin as recited in present claims 5 and 6, or the viscosity of the acid anhydride curing agent as recited in present claims 7 and 10. Accordingly, the Examiner is respectfully requested to reconsider and withdraw the rejection.

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In view of the above, reconsideration and allowance of remaining claims 5-7, 9-10, and 12 of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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WASHINGTON OFFICE



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PATENT TRADEMARK OFFICE

Date: April 17, 2003

APPENDIX
VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE TITLE:

The title is changed as follows:

~~EMBEDDING RESIN AND WIRING SUBSTRATE USING THE SAME~~
EMBEDDING RESIN

IN THE CLAIMS:

Claims 8 and 11 are canceled.

The claims are amended as follows:

5. (amended) A wiring substrate comprising: an insulating substrate having an opening; at least one electronic part disposed in the opening; and an embedding resin comprising a thermoplastic resin, an acid anhydride curing agent, a curing accelerator, and a filler having a particle size of from 0.1 to 50 μm in an amount of from 51 to 74% by weight, wherein the embedding resin shows a viscosity of not higher than 85 Pa \cdot s in a shear rate of 8.4 s⁻¹ after being allowed to stand for 24 hours at 25°C \pm 1°C, wherein the at least one electronic part is embedded with the embedding resin which shows, before embedding, a viscosity of not higher than 85 Pa \cdot s in a shear rate of 8.4 s⁻¹ after being allowed to stand for 24 hours at 25°C \pm 1°C.

6. (amended) A wiring substrate comprising: a core substrate; and a build-up layer provided on at least one side of the core substrate and formed by alternately laminating an insulating layer and a wiring layer, wherein at least one of the core substrate and the building-up layer has an opening penetrating therethrough, and an electronic part is disposed in the opening

and embedded with an embedding resin comprising a thermoplastic resin, an acid anhydride curing agent, a curing accelerator, and a filler having a particle size of from 0.1 to 50 μm in an amount of from 51 to 74% by weight, wherein the embedding resin shows, before embedding, a viscosity of not higher than 85 Pa \cdot s in a shear rate of 8.4 s^{-1} after being allowed to stand for 24 hours at 25°C \pm 1°C.

7. (amended) The ~~embedding resin~~ wiring substrate according to claim 5, wherein the acid anhydride curing agent, before embedding, has a viscosity at 25°C \pm 1°C of not higher than 170 mPa \cdot s.

9. (amended) The ~~embedding resin~~ wiring substrate according to claim 5, wherein the filler contains at least one inorganic filler.

10. (amended) The ~~embedding resin~~ wiring substrate according to claim 6, wherein the acid anhydride curing agent, before embedding, has a viscosity at 25°C \pm 1°C of not higher than 170 mPa \cdot s.

12. (amended) The ~~embedding resin~~ wiring substrate according to claim 6, wherein the filler contains at least one inorganic filler.

IN THE ABSTRACT OF DISCLOSURE:

The abstract is changed as follows:

Abstract of the Disclosure

~~An~~ A wiring substrate includes (1) an insulating substrate having an opening, or a core substrate and a build-up layer wherein at least one of the core substrate and the build-up layer has an opening, (2) at least one electronic part disposed in the opening, and (3) an embedding

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resin ~~includes~~ comprising a thermoplastic resin, an acid anhydride curing agent, a curing accelerator, and a filler, wherein the embedding resin shows a viscosity of not higher than 85 Pa · s in a shear rate of 8.4 s^{-1} after allowing to stand for 24 hours at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$.